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Blood profile, production and milk quality of ETAWAH crossbred goats in response to *Nothopanax scutellaium* Merr extraction

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Abstract
This study aimed to determine the effect of *Nothopanax scutellaium* Merr (NS) extraction on blood profile, production and milk quality of Etawah crossbreed goats. Sixteen lactating Etawah crossbreed goats, aged 2.5-3.0 years, were used. The research treatments were P0=30% concentrate+70% forage, P1=P0+20 gram of NS powder, P2=P0+20 gram of NS extracted with alcohol, and P3=P0+20 gram of NS extracted with water, each repeated four times. The research variables included blood profile, feed consumption, production Dan milk quality. The data obtained was analyzed using the SAS program. NS extraction reduced leukocytes, monocytes, blood lymphocytes dan SCC in Etawah crossbred goats (p<0.05). NS extraction resulted in higher dry matter, protein, energy, and fat consumption (p<0.05), and increased milk production, especially P1 and P2 (p<0.05). NS extraction did not affect milk quality except lactose and milk dry matter. This study concluded that 20 mg NS powder and alcohol reduced leukocytes, lymphocytes, SCC, increased ration consumption and milk production in Etawah crossbred goats.

Keywords: Extraction, blood profile, *Nothopanax scutellaium* Merr, milk production

Introduction
Research has successfully increased milk production in Etawah crossbred goats by up to 32% by administering exogenous hormones, increasing udder growth during pregnancy by 66%[1]. However, high milk production is accompanied by a more rapid decline and a higher incidence of udders infection. Udder infection is a contributing factor to low milk production. Therefore, alternatives are needed to reduce infection [2].

Udder infection is a problem in dairy farming, both in Indonesia and globally. Udders infection can reduce milk production in dairy cows by 2.6-43.1%[3], and in Europe causes losses of EUR 1.55 billion [4]. Subclinical udder infection does not show signs of changes in the udder or milk. However, there is damage to milk, a decrease in the number of udder secretory cells and milk production [5]. A common reaction in infected udder is the infiltration of inflammatory cells from the blood to the site of inflammation, accompanied by impaired milk synthesis [6]. This results in a decrease in lactose, casein, and milk fat [7]. Decreased lactose secretion can reduce milk production, as lactose plays a role in binding water for milk production [8]. One way to reduce udder infection is to administer *Nothopanax scutellarium* Merr. Previous research has shown that administering tannin-protected NS can reduce somatic cell count [5].

NS is herbal plant widely used by people as a cooking ingredient. NS functions as an anti-inflammatory antibacterial, effective in treating wounds and inflammation, treating anemia, treating breast inflammation, swelling, and increasing breast milk production [9-11]. This condition is because NS contains flavonoids, saponins, phenols, terpenes, coumarins, and alkaloids. NS contains quite high protein 18.11%, flavonoids 0.87%, saponins 1.32%, and tannins 1.08% [12].

Flavonoids are strong antioxidants, capable of inhibiting enzymes and mediators involved in the inflammatory process, such as prostaglandins and cytokines. Saponins are immunomodulatory and anti-inflammatory agents that can suppress the immune response and can bind cations, so they can stabilize erythrocyte membranes and other biological macromolecules [13, 14]. Terpenoids and alkaloids are able to reduce the activity of inflammation-causing enzymes such as COX-2 (Cyclooxygenase-2 [15, 16]. The anti-inflammatory effect of NS likely occurs through the inhibition of pro-inflammatory enzymes, such as COX and LOX, which are involved in prostaglandin and leukotriene synthesis. It also reduces the production of pro-inflammatory cytokines, such as TNF-α, IL-1β, and IL-6. Antioxidant activity helps reduce oxidative stress, a trigger for chronic inflammation. Furthermore, NS has been shown to reduce S. aureus colonies that cause mastitis in rabbits [17]. This results in a decrease in blood leukocytes.

The role of NS as an anti-inflammatory and treatment for mammary inflammation is expected to reduce udder infections in goats. To optimize the nutrients and active ingredients of NS, extraction is performed. Extraction is an effort to separate the active ingredients using an appropriate solvent. Ethanol and distilled water are quite effective and commonly used solvents [18]. Ethanol is a solvent that obtains many asiaticosides from plants through maceration. Other research has found that extraction using water and ethanol has also demonstrated anti-inflammatory effects [19].

Based on the above conditions, this study aims to determine the effect of administering NS extract on the blood profile, production and quality of Etawah crossbred goat milk.

Materials and Methods

Sixteen lactating Etawah crossbred goats, aged 2.5-3.0 years, with a milk production range of 221-315 g/head/day, were used. The diet consisted of 70% forage (*Pennisetum purpureum*) and 30% concentrate. The concentrated ingredients included bran, soybean meal, palm kernel meal, and top mix. The nutritional content of the research rations is shown in Table 1.

Table 1: Nutritional content of research ration

Nutrition	Forage (analysis results)	Concentrate (analysis results)	Feed* (calculation result)
Dry matter (%)	21.10	68.24	35.24
Crude fiber (%)	38,56	6,72	29,01
Abu (%)	10.54	10.14	10.42
Crude protein (%)	10.35	21.23	13.62
Crude fat (%)	2.87	3.56	3.08
Ether ekstract (%)	37.68	58.35	43.89
Calcium (%)	2.17	0.98	1.81
Phospor (%)	0.31	0.47	0.36
Energi (kcal/kg DM)	3756.00	4029.00	3837.90

Note: Laboratory analysis results from the Livestock Research Institute, Bogor.

NS was obtained by harvesting the leaves, then cleaning them with running water and drying them. Afterward, the NS was chopped into 1-2 cm pieces. The NS was dried at 40°C for 48 hours. The NS was then ground and sieved with a 1.5 mm mesh size. The resulting NS was extracted with alcohol and water. The resulting extract was fed to goats as a treatment.

NS extraction using alcohol followed a modified method by Ahirwar and Tembhre [20]. NS extraction was performed by soaking the NS in 96% ethanol at a 1:1 ratio. The soaking was carried out for 48 hours. Afterward, the solution was filtered and evaporated using a rotary evaporator.

NS extraction using water was performed by mixing the NS with distilled water in a 1:1 ratio for 48 hours and filtering. The resulting solution was evaporated using a rotary evaporator. The results of the analysis of flavonoids, saponins, and tannins from NS extraction can be seen in Table 2.

Table 2: Flavonoid, saponin, and tannin content of NS

Nutrition	NS powder	NS alcohol extraction	NS water extraction
Flavonoid (%)	0,88	1,87	1,69
Saponin (%)	1.32	2,54	2,33
Tannin (%)	1.07	1,25	1,34

The study used a randomized block design with four treatments and four replications. The treatments were P0=30% concentrate +70% forage, P1=P0+20 g NS powder, P2=P0+20 g NS alcohol extraction, and P3=P0+20 g NS water extraction.

They were milked twice daily manually at 7:30 and 17:30. Milk production from morning and evening milking's was averaged to determine daily milk production per cow. Blood sampling was conducted at the end of the study. Six milliliters of blood were collected from the jugular vein in the morning before the goats were rations. The blood samples were placed in a cooling box and transported to the laboratory for analysis of hemoglobin, leukocytes, erythrocytes, basophils, lymphocytes, hematocrit, monocytes, MCHC (mean corpuscular hemoglobin concentration), MCV (mean corpuscular volume), and MCH (mean corpuscular hemoglobin). Blood analysis was performed using an automated hematology analyzer (SM-600 RET 5 diff auto hematology analyzer).

Samples of 150 grams were taken for milk quality analysis once a week during the morning milking. The milk samples were placed in plastic bags and placed in a cooling box containing ice. The milk samples were then transported to the laboratory for milk quality analysis.

Specific gravity was measured using a lactodensimeter. Milk fat was analyzed using the Gerber method [21]. Milk protein was analyzed using the method Rowland [22]. Somatic cell count (SCC) using the Breed and Prescott method [23].

The data were analyzed for variance using the SAS program [24]. Significant differences between treatments were further analyzed using the Duncan's range test.

Results and Discussion

Blood Profile

The blood profile of Etawah Crossbred goats treated with NS extraction can be seen in Table 3.

Table 3: Blood profile of Etawah crossbred goats treated with NS Extraction

Parameter	Treatment			
	P0	P1	P2	P3
Leukocytes (10^3/µl)	17,2±2,42[a]	15,3±3,02[b]	14,0±34,4[c]	15,1±3,25[b]
Lymphocytes	84,2±0,00[a]	81,0±3,22[a]	75,3±3,20[b]	77,1±1,38[b]
Monocytes	10,0±4,28[a]	5,00±4,25[a]	7,00±5,00[b]	6,00±3,86[b]
Hemoglobin (g/dl)	8,67±0,51	8,92±0,31	8,82±0,57	8,57±0,86
Erythrocytes (10^6/ul)	11,4±0,36	11,6+,05	11,3±0,35	11,1±0,12
Neutrophils	9,01±4,00	7,77±2,08	8,00±5,62	8,00±5,23
Basophils	5,12±1,00	4,33±2,51	4,77±3,01	4,23±1,13
Hematocrit	24,9±1,23	25,2±0,15	24,0±2,11	23,5±0,25
MCHC (g/dl)	135±20,9	134±4,44	195±22,2	187±12,2
MCV	35,1±0,49	34,9+0,25	33,3±2,41	32,6±0,72
MCH	46,9±9,17[a]	46,4±1,60[a]	63,9±5,56[b]	60,7±3,45[b]

[abc] Means in the same row without common letter are different at $p<0.05$

NS extraction can reduce blood leukocytes in PE goats ($p<0.05$). P0 was higher than P1, P2, and P3, while P1 is different from P2 but P1 and P3 are not different. This condition is thought to be due to the administration of NS extraction, which can reduce udder infection, resulting in lower blood leukocytes. Leukocytes in the blood indicate the presence of infection in the body, the higher the leukocyte counts, the higher the udder infection. Leukocytes in the form of eosinophils are responsible for fighting infection [25]. Infection in the udder causes leukocyte cells to gather to eliminate microorganisms attached to udder cells, such as polymorphonuclear neutrophils (PMNs), monocytes, and macrophages. The results of study with PE goat blood leukocytes of 14, 69 x 10^3 cells/mm [26].

NS extraction decreased lymphocytes and monocytes in the blood of Etawah Crossbred Goats ($p<0.05$). Treatment of P0 is different from P2 and P3 but not different from P. This decrease is thought to be due to NS extraction's ability to reduce infection. Lymphocytes are responsible for the adaptive immune response, particularly against viral infections and immune system regulation, while monocytes are phagocytes that help clear pathogens and damage tissue and are involved in tissue regeneration. Lymphocytes and monocytes are important indicators for determining the immune status of goats during and after infection [27]. Lymphocytes are mostly stored in various areas of lymphoid tissue, except for a few lymphocytes that are temporarily transported in the blood. The main function of lymphocytes is to produce antibodies or act as specialized effector cells in response to antigens carried by macrophages [28]. NS extraction did not affect erythrocyte hemoglobin, basophils, neutrophils, hematocrit, MCV, and MCHC of Etawah crossbred goats. NS extraction tends to reduce blood neutrophils. Neutrophils function as the first line of defense against bacterial infections. Neutrophils respond more quickly to inflammation and tissue injury than other leukocytes [29]. The increase in neutrophil count in subclinical mastitis can vary depending on factors such as the type of bacteria causing the infection, the goat's health condition, and the individual's response to the infection [30].

Ration Consumption

Ration consumption of Etawah crossbred goats fed with NS extraction is shown in Table 4.

Table 4: Ration Consumption of Etawah crossbred goats fed with NS extraction

Paramater	Treatment			
	P0	P1	P2	P3
Dry Matter (g/head)	992±08,2[A]	1068±37,1[B]	1067±10,4[B]	1021±38,2[C]
Protein (g/head)	139±10,4[A]	163±6,01[B]	149±2,81[B]	143±6,11[C]
Fat (g/head)	38,5±2,53[A]	45,7±1,94[B]	44,9±0,63[B]	41,9±1,60[C]
Crude Fiber (g/head)	529±29,5[A]	607±26,2[B]	598±6,70[B]	564±19,8[C]
Ether ekstract (g/head)	971±46,5[A]	917±39,8[B]	903±10,8[B]	848±29,9[C]
Calcium (g/head)	40,7±1,90[A]	45,4±1,96[B]	44,8±0,39[B]	42,6±1,68[C]
Phospor (g/head)	2,80±0,16[A]	3,52±0,18[B]	3,46±0,05[B]	3,14±0,15[C]
Energi (kcal/kg DM)	6721±137[A]	7076±224[B]	7089±99[B]	6134±175[C]

[ABC] Means in the same row without common letter are different at $p<0.01$

NS extraction can increase the consumption of dry matter, protein, fat, crude fiber, ether extracts, energy, Ca and P in Etawah Crossbred goat rations ($p<0.01$). Treatment P0 differs from P1, P2 and P3. Treatment P1 differs from P3 but does not differ from P2. The highest consumption of dry matter, protein, fat, crude fiber, Ca and P in rations was found in P1 and P2. This condition is thought to be because the administration of NS extraction can improve feed palatability. Herbal plants containing flavonoids and saponins can stimulate palatability, resulting in increased chicken feed consumption [31], but research in goats still needs proof. Flavonoids can increase appetite and are able to form the immune system, so that a healthy body condition supports appetite [32]. Saponins can stimulate digestive process activity and increase nutrient absorption [33]. Flavonoids and saponins can increase appetite through different but complementary mechanisms. Flavonoids reduce fat storage and increase nutrient absorption, while saponins stimulate digestive activity and enhance nutrient absorption. The combination of the two has a significant effect on increasing appetite and overall digestive health. NS extraction increased calcium and phosphorus consumption in Etawah crossbred goats ($p<0.01$). Calcium in lactating goats plays a crucial role in ensuring adequate milk calcium. Calcium deficiency can lead to bone calcium breakdown, which, if prolonged, can lead to paralysis.

Milk production and quality: The milk production and quality of crossbred goats in response to NS extraction can be seen in Table 5.

Table 5: Milk production and quality of crossbred goats Treated with NS Extraction

Paramater	Treatment			
	P0	P1	P2	P3
Milk production (g/day)	232±72,2[a]	287±17,8[b]	286±17,9[b]	264±23,2[c]
Milk dry matter (%)	13,2±1,27	13,3±1.21	13,5±1,99	13,5±1,42
Specific gravity	1,028±0,07	1.028±0.08	1,028±0,11	1,028±0,12
Protein (%)	3,81±0,23	3,87±0,34	3,89±0,36	3,46±0,32
Fat (%)	3,79±0.18	3,94±1.12	3.87±0,98	3.87±1.10
Lactosa (%)	3,44±0,23[A]	3,56±0,24[B]	3,61±0,19[B]	3,26±0,15[C]
Solids nonfat (%)	9,83±0,25[a]	9,39±0,24[b]	9,62±0,13[c]	9,60±0,22[c]
pH	6,21±0,02	6,16±0,03	6,21±0,05	6,22±0,06
SCC (sel/ml)	899±112[a]	525±98,4[b]	612±101[b]	565±122[b]

[abc] Means in the same row without common letter are different at $p<0.05$
ABC Means in the same row with different capital superscripts differ significantly ($p<0.01$)

NS extraction can increase milk production of Etawah Crossbred goats ($p<0.05$). Treatment P0 is different from P1, P2, and P3. While P1 and P2 are not different, they are different from P3. The highest milk production is found in P1 and P2, followed by P3. This condition is suspected because NS contains flavonoids that have high antioxidant activity. Flavonoids have antioxidant activity, thus stimulating breast milk secretion by regulating the hormone prolactin, but the mechanism is not yet known [34]. Antioxidants can improve the function of udder alveolar cells, so that the epithelium is well maintained [35], ultimately increasing milk production.

Several active compounds, such as phenolics, saponins, tannins, flavonoids, carvacrol, and other essential oils, inhibit methanogenesis in the rumen. This can reduce rumen methane emissions and increase livestock productivity [36]. Flavonoids are useful as diuretics, antibacterials, antioxidants, and treat udder inflammation [10], resulting in healthier udder glands. The administration of *Coleus amboinicus* extracted with alcohol resulted in milk production of 401.87±79.52 g/head and 312.90±73.36 g/head with water extraction [37].

NS extraction had no significant effect on the dry matter, specific gravity, protein, and fat content of Etawah Crossbred goat milk ($p>0.05$). NS extraction had a very significant effect on the lactose content of Etawah Crossbred goat milk ($p<0.01$). Treatment P3 differed from P0, P1, and P2, while there was no difference between P0, P1, and P2. NS extraction significantly affected the solids nonfat of Etawah Crossbred goat milk ($p<0.01$). Treatment P3 differed from P0, P1, and P2, while there was no difference between P0, P1, and P2. The increase in lactose content was associated with increased milk production. This is thought to be due to lactose acting as an osmotic driver and having strong osmotic properties, thus drawing water into the lumen and increasing milk volume [38].

NS extraction can reduce the somatic cell count (SCC) of Etawah crossbred goat milk ($p<0.05$). Treatment P0 was higher than P1, P2, and P3, but there was no difference between P1, P2, and P3. The decrease in milk SCC is thought to be due to the anti-inflammatory properties of NS, which can reduce SCC. NS's anti-inflammatory properties are related to its flavonoids and saponins. Flavonoids are strong antioxidants and can inhibit mediator enzymes involved in the inflammatory process, such as prostaglandins and cytokines. In addition, saponins are immunomodulatory and anti-inflammatory agents that can suppress excessive immune responses. Terpenoids and alkaloids can suppress the activity of inflammation-causing enzymes such as COX-2 [15, 16]. The anti-inflammatory effect of NS most likely occurs through the inhibition of pro-inflammatory enzymes, such as COX and LOX, which are involved in prostaglandin and leukotriene synthesis. Decreased production of pro-inflammatory cytokines, such as TNF-α, IL-1β, and IL-6. Various terpenoids (sesquiterpenes, diterpenes, and triterpenoids) can inhibit COX 2 and LOX 5 [16]. Antioxidant activity also helps reduce oxidative stress, a trigger for chronic inflammation.

Conclusions

The study concluded that 20 mg of NS in a powder and extraction alcohol reduced leukocytes, lymphocytes blood, increased ration consumption and milk production in Etawah crossbred goats.

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Conflict of Interest

Not available

Reference

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